HETEROSTYLY IN OPLONIA (ACANTHACEAE)

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IN A RECENT REVIEW of the distribution of heterostyly in flowering plants (Vuilleumier, 1967), the Acanthaceae were not mentioned. Subsequently, however, Stearn (1971) reported distyly for several species of *Oplonia* (FIGURE 1), a shrubby genus of the West Indies, northern South America, and Madagascar, and concluded that "heterostylous floral dimorphism probably occurs throughout the genus." His descriptions of floral morphology indicate that at least eight of the fourteen species exhibit distyly. In view of this apparently unique occurrence of heterostyly in the Acanthaceae, and because of the absence of any information on morphological and physiological traits associated with dimorphism in style length and anther position, I visited Jamaica in 1973, obtained living material of *Oplonia* species, and made field observations on population composition. Subsequently, plants were established at the Botanical Garden of the University of California, Berkeley. These were utilized in the present study, which presents the results of pollen measurements and a crossing program.

MATERIALS AND METHODS

Population composition of two species was determined in the field by recording the floral morphology of all individuals encountered. Pollen size was determined by mounting living pollen in aniline blue-lactophenol on a

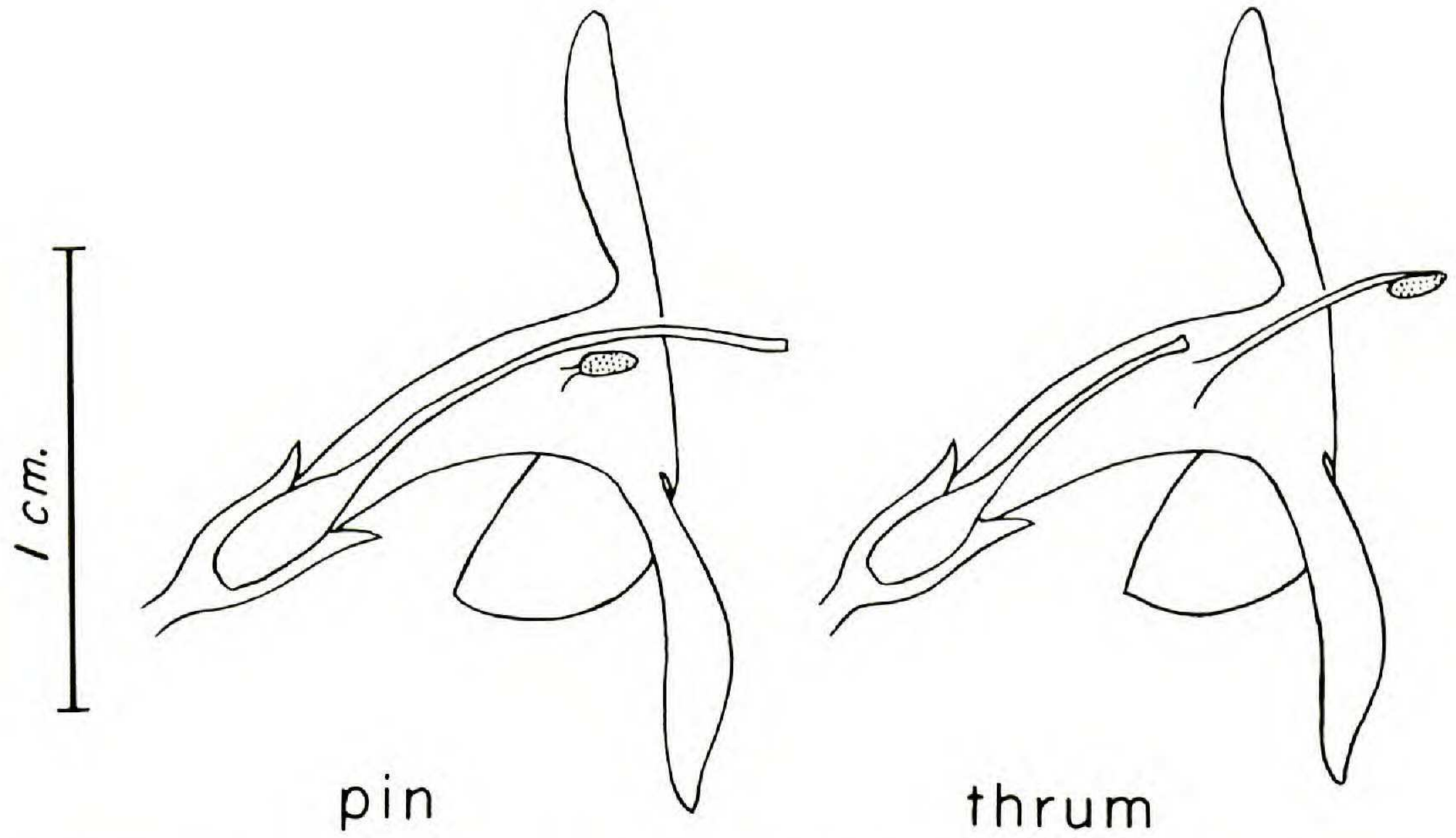

FIGURE 1. Pin and thrum flowers of **Oplonia armata** var. **pallidior** showing relative positions of anthers and stigmas of the two morphs.

glass slide and making measurements by means of an ocular micrometer. For the crossing program, flowering individuals were placed in an insect-free greenhouse, the pollinated flowers were tagged, and seed set was recorded. The following populations were utilized: *Oplonia acicularis* (Swartz) Stearn (*Ornduff 7816*, along Priestman's River, Portland Parish), *O. armata* (Swartz) Stearn var. *pallidior* Stearn (*Ornduff 7813*, cultivated plants on the University of West Indies campus, Kingston, originally from Lucea, Hanover Parish, and *Ornduff 7815*, between Bengal Bridge and Discovery Bay, Hanover Parish), and *O. microphylla* (Lam.) Stearn (*Ornduff 7814*, Four Mile Wood, St. Thomas Parish).

RESULTS

POPULATION COMPOSITION. A survey of a population of *Oplonia microphylla* (*7814*) produced 20 plants with long-styled ("pin") flowers and 16 plants with short-styled ("thrum") flowers ($Z = 0.667$); that of a population of *O. armata* var. *pallidior* (*7815*) yielded 18 pin plants and 13 thrum plants ($Z = 0.898$). Thus, the figures for both populations, when subjected to the Z test, indicate that the pin : thrum ratio was 1 : 1.

POLLEN CHARACTERISTICS. Pin pollen grains of *Oplonia microphylla* averaged 39.8 μm. in diameter (sample size (N) = 60; range = 35.1–44.9), and thrum grains averaged 45.8 μm. (N = 60; range = 41.0–54.6); both failed to stain positively with iodine-potassium iodide (IKI). Pin pollen grains of *O. armata* var. *pallidior* averaged 59.8 μm. in diameter (N = 60; range = 50.7–72.2), and thrum grains averaged 46.2 μm. (N = 60; range = 41.0–54.6); both stained positively with IKI.

POLLINATIONS. Self- and intramorph pollinations of *Oplonia armata* var. *pallidior* produced an average of 2.6 seeds per pollination, while intermorph pollinations produced 2.5 (TABLE 1), indicating that in this variety distyly is not accompanied by self-incompatibility. Within *O. microphylla* intramorph pollinations produced an average of 1.7 seeds per pollination, and intermorph pollinations produced an average of 2.7 (TABLE 1), suggesting that in this species distyly is accompanied by a weak incompatibility system.

DISCUSSION

The occurrence of heterostyly in *Oplonia* is unique in the Acanthaceae, a large and diverse family of approximately 250 genera (Airy Shaw, 1973), and in the Bignoniales (*sensu* Thorne, 1976). Unlike most heterostylous plants of other, unrelated families, *Oplonia* has strongly zygomorphic flowers and a weak or absent incompatibility system. Also in several heterostylous taxa examined, thrum pollen stains positively with IKI while pin pollen does not (Ornduff, unpubl.). The pollen of both morphs of *O. armata* var. *pallidior* stains positively, unlike that of *O. microphylla*. The significance of these intermorph differences in pollen stainability is unknown.

TABLE 1. **Results of intra- and intermorph pollinations of Oplonia species.**

TAXON	COLLECTION	CROSS	NUMBER OF FLOWERS POLLINATED	NUMBER OF SEEDS OBTAINED	AVERAGE NUMBER OF SEEDS PER POLLINATION
O. armata var. *pallidior*	*Ornduff 7813*	Pin selfed	32	94	2.9
		Pin × pin	22	47	2.1
			54	141	2.6
		Thrum selfed	19	44	2.3
		Thrum × thrum	9	26	2.9
			28	70	2.5
		Total intramorph	82	211	2.6
		Pin × thrum	33	95	2.9
		Thrum × pin	17	30	1.8
			50	125	2.5
O. microphylla	*Ornduff 7864*	Pin selfed	1	1	1.0
		Pin × pin	5	9	1.8
			6	10	1.7
		Thrum selfed	6	10	1.7
		Thrum × thrum	—	—	—
		Total intramorph	18	30	1.7
		Pin × thrum	9	27	3.0
		Thrum × pin	6	14	2.3
			15	41	2.7

During the several hours spent in the field examining populations of *Oplonia*, only one flower visitor was noted — a pierid butterfly of the species *Phoebis sennae* (L.). It is probable that the large-flowered species are pollinated by lepidopterans, since the arched, exserted stamens of thrums and the similarly exserted styles of pins suggest that intermorph pollination is mediated by insects that alight on the corolla but whose bodies are positioned some distance in front of it.

The nature of the floral morphology of *Oplonia acicularis* is puzzling. The description by Stearn (1971) suggests that the flowers are not distylous. The flowers are small (ca. 5 mm. long); examination of those collected from several plants indicates that some plants produce flowers with stigmas positioned opposite or below the anthers, and others produce flowers with stigmas positioned slightly above the anthers. Under insect-free conditions and without artificial pollination, one of the two plants of the former type and one of four plants of the latter produced fruits. It is likely that *O. acicularis* possesses a slight degree of distyly, that self-incompatibility is absent in this species, and that stigmas and anthers are sufficiently close in some individuals that spontaneous self-pollination takes place.

Despite the fact that *Oplonia armata* var. *pallidior* seemingly lacks an incompatibility system, the 1 : 1 pin : thrum ratio in the single natural population examined suggests that it is effectively outcrossed.

ACKNOWLEDGMENTS

This study was supported in part by grants from the National Science Foundation. I wish to thank Patricia Watters for technical assistance, H. V. Daly and J. A. Powell for the insect identification, and Robert W. Read for assistance in the field.

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